BREAK-EVEN ANALYSIS

In your business planning, have you asked questions like these?

- How much do I have to sell to reach my profit goal?
- How will a change in my fixed costs affect net income?
- How much do sales need to increase to cover a planned increase in advertising costs?
- What price should I charge to cover my costs and allow for a planned amount of profit?

These are some of the questions that you can easily answer by using *break-even analysis*. In the next pages, you will learn what break-even analysis is; see examples of how the technique works in manufacturing, retailing, and service businesses; and find out how you can use it in your own business planning. Break-even analysis is a very useful tool that can help you understand the sources of profit in your business.

BASIC DEFINITIONS

Break-even analysis is the use of a simple mathematical formula to determine the sales level at which the business is neither incurring a loss nor making a profit. In other words, when the firm's total expenses equal its net sales revenue that is the *break-even point* for the operation.

Defining the break-even point in mathematical terms is simply the point where:

Total Expenses = Net Sales Revenue

The amount of sales revenue should be readily available on your income as "*Net Sales*". Net sales revenue is all sales revenue (often called gross revenue) less any sales returns and allowances or sales discounts. If your business is brand new and you have no income statement yet, you will need to use a projected sales figure. This will work for any of the calculations outlined in this guide. "*Total Expenses*" also appears on your income statement (or projections). You will find most expenses listed under the heading "*operating expenses*" or "*general and administrative expenses*". Additional expenses to include in your analysis are found on the line labeled "*Cost of Goods Sold*" on a retailer's income statement or "*Cost of Goods Manufactured*" on a manufacturer's income statement.

To use the break-even technique, you need to do further analysis of your expenses. You need to classify them as either "*fixed*" or "*variable*".

Fixed Costs are those expense items that generally do not change in the short-run regardless of how much you sell. Fixed costs are typically the expenses that you pay out regularly that do not go up or down with sales level. Examples of fixed costs include general office expenses, rent, depreciation, utilities, telephone, property tax, and the like. Obviously *all* expenses vary over the long run. For example, rent and property tax increase every year. In break-even analysis though, our calculations are based on short-run information in order to reveal the current profit structure of the business.

Variable Costs are those expenses that change with the level of sales. These costs vary with sales because they are directly involved in making the sale. Examples of variable costs include direct materials and direct labor in a manufacturing firm; or cost of goods sold, sales commissions, and

billing costs in a retail firm. These are only a few of the many kinds of variable costs that you will probably encounter in a manufacturing or retail firm.

Typically, service businesses do not have large variable costs, other than labor. A service business, like an accounting firm for example, may have only the expense of billing as variable costs. Other expenses that may be relevant as variable costs in a service business include materials routinely given to clients, materials used in the process of offering the service, the cost of hourly labor to provide the service, and commissions paid to individuals selling the service.

Using the definitions provided above, you should be able to classify all of your expenses as either fixed or variable. To begin the classification process, make two lists: one labeled "fixed" and the other labeled "variable". Record each of the expense items located on your income statement or financial projection on one of these lists. If you are not sure which list is right for a particular expense item, here's an easy test to determine if it is fixed or variable. Ask yourself this question: If I did not sell any of my product or service during the next month, quarter, or year (whichever period is relevant for your break-even analysis), would I still have to pay this expense? If the answer is yes, that item is a fixed cost.

Some items may seem to have both fixed and variable cost characteristics. If that is the case, try to determine what portion of the cost is fixed and what portion of the cost is variable for your two lists. For example, you might split telephone costs as 60% variable and 40% fixed if you were a telemarketing firm. This step involves a good deal of judgment; so don't be too concerned if you feel you are making inexact choices. Just make sure you have some good reason for your classifications. (See the following example).

With all of the additional information you now have, we can adjust the break-even formula to better serve as a planning tool. Substituting the sum of fixed costs plus variable costs for the term "*Total Expenses*", we get:

Fixed Costs + Variable Costs = Net Sales Revenue

There is something slightly misleading about the formula as it stands, however. As you know, variable costs are associated with a change in the level of sales. So the "variable costs" part of the formula should reflect their direct connection with sales level. That connection can be made mathematically by expressing the amount of variable costs as the variable cost **per unit**.

We will discuss how to figure variable cost per unit in the next section. For now, to clear up the misleading nature of the formula as it stands, we will substitute the term "*variable cost per unit*" for the less descriptive "*variable costs*". We now have the final form of the basic break-even formula.

Fixed Costs + Variable Cost per Unit = Net Sales Revenue

Using this formula, we are ready to try an example of basic break-even analysis.

BREAK-EVEN ANALYSIS EXAMPLE

Let us assume that you work for the Reliable Chair Company, a manufacturer of solid wood chairs. You have been asked by the head of the marketing department to calculate a break-even level for monthly sales. In other words, you must determine what level of sales in dollars needs to be met in order to break-even. (While this example uses a manufacturing business, remember

that break-even analysis can be used for both retail and service businesses as well. Refining the analysis for service and retail businesses will follow).

Let us also assume that you have reviewed your company's income statement and classified each of its monthly expenses as either fixed or variable. This is the classification you prepared:

Fixed Costs/Month		Variable Costs/Month	
Building rent	$10,000	Direct materials (wood, varnish, etc.)	$28,800
Property tax	4,000		
Utilities	900	Direct labor	26,400
Telephone	850	Overtime labor	1,500
Depreciation	8,000	Billing costs	2,000
Insurance	500	General maintenance	1,300
Advertising	3,000		
General office salaries	7,000		
General maintenance	700		
TOTAL	$34,950	TOTAL	$60,000

There are two things to notice about this sample classification of expenses. First, general office salaries is included as a fixed cost because in the short run these salaries will be paid regardless of whether any chairs are sold or not during the month. Obviously, if the firm fails to sell chairs for a number of months, the office salaries will decline and would no longer be considered "fixed". This cost would eventually change with the volume of sales. Remember, though, that break-even analysis focuses only on the short run.

The second thing to notice about this classification is that general maintenance expense appears on both the fixed and variable lists. This is because some maintenance costs will be incurred regardless of how many chairs we sell (the fixed portion). The office waste baskets will be emptied, floors washed, and windows cleaned. On the other hand, the more chairs that we sell, the more the machinery will be used so the incidence of breakdown is likely to increase which will require more maintenance (the variable portion). How maintenance costs are divided between fixed and variable costs is a matter of judgment. In the example, we have divided maintenance as 35% fixed and 65% variable.

You need just two more pieces of information, both of which are readily available from your business records, before you calculate the break-even point. You need to know your selling price and the number of chairs projected to be sold this month. (Remember, our example is using one month as the relevant period). The selling price is known for an existing business. If you are just starting out, you must use your projections again. You will find, however, that break-even analysis can actually help you determine your selling price. The expected number of unit sales can be arrived at based on projections if the business is new, or on past performance if the business has been up and running.

Currently, Reliable chairs are selling to your dealers for $250 each. This same month last year, Reliable sold 550 chairs. Your business has enjoyed moderate growth over the last year, so you make the reasonable assumption that 600 chairs will be sold this month. Let's summarize what we know so far:

$34,950 total monthly fixed costs
$60,000 total monthly variable costs
$250 selling price of one chair
600 expected number of chairs to be sold this month

Here's where we figure "*variable cost per unit*". Simply divide the total variable costs by the number of units we expect to sell to get variable cost per unit. An existing business may use a previously calculated variable cost per unit figure, but it is best to review variable costs and expected sales at least annually to assure the most accurate data in doing your break-even analysis. In general, the formula for figuring variable cost per unit looks like this:

Total variable costs/Expected number of units to be sold

The calculation for this example looks like this:

$60,000/600 = $100 variable cost per unit

In other words, for every chair that we expect to sell this month, $100 of its cost is due to what we earlier classified as variable expenses.

Break-Even in Units

You are now ready to calculate the break-even level of sales for the Reliable Chair Company. We will let "X" stand for the number of chairs needed to break-even in the formula. The net sales revenue at the break-even point will be $250 times X number of chairs. In our formula, net sales revenue equals the selling price per unit times the number of units sold.

Similarly, while variable cost per until is $100, total variable costs equals $100 times X number of chairs. In our formula, variable costs equal variable costs per unit times the number of units sold. Now simply plug the values we have previously calculated into the break-even formula. That will look like this:

Fixed Costs + Variable Costs = Net Sales Revenue
$34,950 + $100X = $250X

Using a little algebra to solve the equation, we find:

$34,950 = $250X - $100X
$34,950 = $150X
X = 233

In other words, Reliable needs to sell 233 chairs during the month in order to just cover all expected expenses. At the 233-chair point, Reliable will not be making any profit or incurring a loss, but with the very next chair they sell, profit will begin to accrue.

Break-Even in Dollars

You can also compute the break-even level in terms of dollars. We know how many chairs need to be sold and how much each chair sells for, so multiplying chairs times dollars per chair will result in the break-even level of sales dollars. The calculation is:

233 chairs x $250 per chair = $58,250

Another way of thinking about this number is that once Reliable's sales for the month have passed $58,250, they should be making a profit. The words "should be" are important. Remember that many of the figures we used in determining fixed and variable costs were based on judgment. The figures for a business that is still in the planning stage are estimates or projections. This means that it is probably best not to rely on a single number like the 233 chairs we calculated as the break-even point. It is better to use the real power of break-even analysis to develop a range of points that better define what might actually happen.

Break-Even to Set Price

In the above calculation, we assumed price was set at $250. What happens to our break-even point if we lower the price to $225? Use the formula to find the answer:

Fixed Costs + Variable Costs = Net Sales Revenue
$34,950 + $100X = $225X

Solving as before:

$34,950 = $225X - $100X
$34,950 = $125X
X = 280 (rounded)

We find that the number of chairs we will have to sell to break-even went up just over 20% when we cut our price by 10%. Now imagine if you re-calculated the break-even point for a whole range of item prices. You would come up with a corresponding range of break-even points. You can use that range to judge the feasibility of actually reaching different sales levels. You might decide that it is physically impossible to produce the number of units needed to break-even at the lowest item price in your range of reasonable prices in the actual marketplace. This would be a good advance indication of a potential problem. Possibly the project is not feasible. On the other hand, it could be an indication that your classification of expenses is off. You can try adjusting your estimate of fixed expenses to see how that affects break-even.

Let's try another example as an illustration of adjusting your estimates. Let's assume the actual fixed maintenance cost is $2,000. In other words, there is no variable component to this expense item; all maintenance costs are fixed. This might be the case if, for example, Reliable contracted with the machinery manufacturer to provide maintenance on a contract basis. The reason for contract maintenance, of course, is to keep variable costs from increasing beyond acceptable limits. The fixed and variable cost classifications now look like this:

Fixed Costs/Month		Variable Costs/Month	
Building rent	$10,000	Direct materials (wood, varnish, etc.)	$28,800
Property tax	4,000		
Utilities	900	Direct labor	26,400
Telephone	850	Overtime labor	1,500
Depreciation	8,000	Billing costs	2,000
Insurance	500	General maintenance	-0- -
Advertising	3,000		
General office salaries	7,000		
General maintenance	2,000		
TOTAL	$36,250	TOTAL	$58,700

Therefore, the new variable cost per unit will become:

$58,700/600 = $97.83 per unit

(This assumes, of course, that there is no change in the expected number of chairs to be sold this month). How does the change in classification affect break-even? Look at the formula:

Fixed costs + Variable costs = Net sales revenue

$36,250 + $97.83X = $250X

and solving:

$36,250 = $250X - $97.83X

$36,250 = $152.17X

X = 239 chairs (rounded)

The new break-even point, as a result of the change in classification of expenses, is calculated to be 239 chairs. In this case, the change in maintenance expense classification didn't have much impact on the break-even point since it increased by only six chairs. One could conclude then, if the management at Reliable felt that six chairs is not a large amount, that the classification of maintenance expense in this case is not as critical to the determination of feasibility as some other expense items.

The main point to take from this series of examples is that the break-even formula is flexible. You can adjust your estimates and classifications to answer a series of "what if" questions: the kind of what ifs that frequently come up in business. There is an important "what if" question we have yet to address. That is "What if I want to find how much I have to sell to make a certain specified profit?" To answer this question we need to make an adjustment to the basic break-even equation.

THE PROFIT BREAK-EVEN FORMULA

Profit is what is left of the net sales revenue after all expenses have been covered. The basic break-even formula identifies the point at which all expenses have been covered, but where profit has not yet begun to accrue. In other words, implicit in the basic formula is the idea that profit is zero at break-even.

In the original Reliable Chair Company example, break-even looked like this:

Fixed costs + Variable costs = Net sales revenue

$34,950 + $100X = $250X

Actually profit was in the formula, but at a zero value:

Profit + Fixed costs + Variable cost = Net sales revenue

$0 + $34,950 + $100X = $250X

The general form of the formula above, which we will call the "*profit break-even formula*", is the form to use when you want to estimate the level of sales necessary to meet a certain profit requirement. Let's look at an example using the Reliable Chair Company data.

The head of the marketing department at Reliable, being so impressed with your ability to find the break-even level of sales, now gives you the assignment of finding the level of sales necessary to meet desired profit projections. You are told that plans require a profit of $50,000 for the

period under consideration: a month. How many chairs must Reliable sell to make that profit level?

Recall the profit break-even formula and fill in the values we know or have already calculated:

Profit + Fixed costs + Variable costs = Net sales revenue

$50,000 + $34,950 + $100X = $250X

and solving:

$50,000 + $34,950 = $250X - $100X

$84,950 = $150X

X = 567 (rounded)

This means that in order to reach a level of profit at $50,000, Reliable must sell 567 chairs this month. As with the basic break-even formula, the real strength of profit break-even lies in its ability to give you a range of figures to use in your planning.

For example, what if selling 567 chairs a month is physically impossible for Reliable? Suppose Reliable is only able to sell 500 chairs a month because of production constraints? What price would they have to charge to meet the profit condition of $50,000 if all they could sell is 500 chairs? First, recognize that the variable cost per unit will change. Instead of expecting to produce 600 chairs this month we know we are only able to produce 500. So our revised variable cost per unit figure looks like this:

Total variable cost/Number of units to be produced this month

$60,000/500 = $120

And $120 is the new variable cost per unit. If selling price didn't change, Reliable would have to sell:

$50,000 + $34,950 + $120X = $250X

$84,950 = $130X

X = 654 chairs (rounded)

Obviously, given the production restriction of 500 chairs, this solution is not feasible. Price is going to have to increase. How do we know what the new price must be? We could try a series of guesses, plugging in new prices each time until the equation balanced out, but that is time consuming and the answer will not be exact. Instead, let's use a little algebra and adjust the profit break-even equation.

Following the procedure we've been using, the variable cost per unit has always been subtracted from the sales price and the answer multiplied by the number of chairs. The number of chairs was always represented by "X" because the quantity of chairs was unknown. Now, we know the number of chairs and we want to find the sales price. So, let's let "Y" = sales price and fill in the rest of what we know.

The profit break-even formula would then look like this:

Profit + Fixed costs + Variable costs = Net sales revenue

$50,000 + $34,950 + $120 X 500 = $500Y

and solving:

$$\$50,000 + \$34,950 + \$60,000 = 500Y$$
$$\$144,950 = 500Y$$
$$Y = \$289.90$$
$$\text{or } Y = \text{approximately } \$290$$

The above calculation shows that if we must make a target profit of $50,000 and are only able to make 500 chairs in a month, the price that will allow us to meet that goal and stay within our production constraint is $290.00. Obviously charging anything over $290 would insure meeting the profit goal. However, there is a ceiling price above which Reliable will have "priced themselves out of the market." $290 is the lowest price that allows Reliable to meet their profit requirement and hopefully not exceed the market ceiling price.

OTHER APPLICATIONS OF THE PROFIT BREAK-EVEN FORMULA

With a little imagination, the profit break-even formula can be made to provide answers to a variety of questions beyond those we have already explored.

Expansion Decisions

Suppose Reliable Chair needed to expand its warehouse facility by renting additional space. The monthly rent for the new building is $5,000. If nothing else changes, how many chairs must Reliable sell to meet its profit goal?

First recognize that the new rent cost is going to increase Reliable's fixed costs. We shall assume, in this case, that all other variables remain unchanged. The values in the profit break-even formula will change from this:

$$\text{Profit} + \text{Fixed costs} + \text{Variable costs} = \text{Net sales revenue}$$
$$\$50,000 + \$34,950 + \$100X = \$250X$$

to this:

$$\text{Profit} + \text{Fixed costs} + \text{Variable costs} = \text{Net sales revenue}$$
$$\$50,000 + \$39,950 + \$100X = \$250X$$

and solving:

$$\$50,000 + \$39,950 = \$250X - \$100X$$
$$\$89,950 = \$150X$$
$$X = 600 \text{ chairs (rounded)}$$

So the $5,000 expansion is going to require an additional 33 chairs be sold each month in order to maintain the profit goal. Or alternatively, another

$$33 \text{ chairs} \times \$250 \text{ per chair} = \$8,250$$

$8,250 in additional sales is necessary to cover the additional $5,000 in fixed costs and maintain the profit level goal.

Other Increased Costs

This same type of analysis could be done for any planned expenditure that affected fixed costs. For example, a planned increase in advertising or a mandated increase in utility costs could also be handled using this analysis. These examples would increase the fixed costs. Raises given to personnel would increase either fixed or variable costs and possibly both.

As the examples in this guide have shown, any change in either fixed or variable expenditures, a change in sales price, in sales volume, or in the profit goal can be incorporated into the profit break-even formula to determine the impact of the change. All it takes is an ability to recognize what part of the formula is affected and some basic math.

WHAT ABOUT RETAIL AND SERVICE BUSINESSES?

So far the discussion has centered on manufacturing. Break-even analysis applies to retail and service businesses also. To adapt the examples in this guide, simply think about the nature of a retail or service business and what you sell.

For example, if you run a retail store that sells furniture, you will still be able to classify your expenses as fixed or variable. Many of the same type of expense items we saw in the manufacturing example also apply to retailers. Items such as utilities, telephone, depreciation, insurance, advertising, and property tax are all examples of fixed costs for retailers. The majority of variable costs for a retailer may be found in the Cost of Goods Sold line item on the income statement. Cost of goods sold for a retailer relates directly to costs like direct materials and direct labor for a manufacturer. Of course, a retailer might also have other variable costs such as commissions paid to sales people or billing costs.

You will also be able to calculate a variable cost per unit because you can estimate the number of units you expect to sell. The estimate may be based on past experience with a particular product or on projections if you are planning on selling a new line. Of course selling price will also be known or estimated for any of your products.

In a retail business, you are likely to have a variety of products. Break-even is best used on a product-by-product basis. A product-by-product break-even is more meaningful than a store-wide break-even because not all items have the same level of profitability. Determine the percent of total sales that each product line represents and use the same procedure to look at price changes, cost changes, or new profit requirements.

As we have seen, the profit goal is an element of the break-even analysis and its influence needs to be considered separately. In that regard, the discussion of contribution margin below will be particularly useful to retail business owners.

If you have a service business it is likely that you have no tangible "units" to sell. You can still use breakeven, though. Let's look at an example of how to use break-even in a consulting business.

Suppose a consultant advises clients on marketing strategies for their businesses. She has itemized her monthly expenses as either fixed or variable based on the definitions of fixed and Variable costs we have used in this guide. Fixed costs are fairly easy to identify. Let's assume they total $4,500 for monthly rent, utilities, telephone, insurance, and the salary of an assistant.

The variable costs relate to paper, brochures, billing costs, and shared computer time she needs to perform the marketing assessment she does for her clients. Based on experience, or her study of competitors, she concludes she will need to spend 20 hours with each client to adequately address their marketing needs. Using 20 hours per client as a working estimate, she then looks at the costs of computer time, average paper usage, and the time spent billing to determine those total variable costs. These come to approximately $800 per month.

So now how does the consultant figure variable cost per unit? It starts with a definition of what a "unit" is for a service business. For some, it may be the hours of work they can bill. For others, it may be the number of documents they process. Our consultant defines "units" as the number of clients served each month.

Now because our consultant estimates it will take 20 hours to serve each client, approximately how many clients will she be able to serve in a month? Estimating 40 hours per week and 4 weeks per month means there are 160 hours available each month. Since each client takes 20 hours, dividing the 160 total hours by 20 hours per client, she could serve 8 clients a month (assuming a constant demand for her service existed). Because the consultant often works more than 40 hours a week, there is some built-in "down time" in the estimate of 8 clients a month. In other words, the estimate appears realistic given the conditions under which the consultant works.

Because variable cost per unit for this consultant means variable costs divided by number of clients served, her variable cost per unit looks like this:

$800 in monthly variable costs/8clients served in a month
= $100 per client served

Based on the consultant's experience and her review of the going rate for marketing consulting services in her area, she has decided to charge clients $70 per hour for her services. (As an aside, setting prices is a marketing issue based on factors such as knowledge of your customers, the competition, and historical prices to judge what price is reasonable. Pricing policy, however, is beyond the scope of this guide.) In this case, since a "unit" is defined as one client served, we need to relate the price per hour to sales revenue per client. It takes 20 hours to serve a client and at $70 per hour, the sales revenue per client is estimated to be $1,400.

To use the profit break-even formula, the consultant needs to determine what profit level she requires from which to pay herself. Let's assume she decides that, based on her own needs, a monthly profit of $8,000 is a reasonable profit goal. All the variables of the profit break-even formula have been estimated.

Let's summarize the relevant facts the consultant has assembled:
$1,400 = selling price for one unit (client)
$4,500 = fixed costs
$800 = total variable costs
$100 = variable cost per unit (client)
$8,000 = monthly profit goal

It's now a matter of plugging in the values:

Profit + Fixed costs + Variable costs = Net sales revenue

$8,000 + 4,500 + $100X = $1,400X

and solving:

$12,500 = $1,400X - $100X

$12,500 = $1,300X

X = approximately 10 clients

In other words, the consultant is going to have to serve 10 clients in a month if she is going to make her profit goal. Since by her best estimate it is possible to serve only 8 clients a month, this situation is probably not feasible. Note that break-even analysis effectively identified the feasibility of this project. This is another example of how useful the technique is.

So what is the consultant to do? Maybe her profit goal can be reduced. On the other hand, this lack of feasibility is also the result of her estimate of fixed costs, her estimate of variable costs, her estimate of how long it takes to serve one client, and her projected hourly rate. Any of those factors could be changed and the resulting answer judged for feasibility.

For example, what happens to feasibility if the consultant decides to raise her price per hour to $90? The sales revenue per unit will be:

$90 per hour x 20 hours per client = $1,800 per client

And the new profit break-even will look like this:

Profit + Fixed costs + Variable costs = Net sales revenue

$8,000 + $4,500 + $100X = $1800X

and solving:

$12,500 = $1,800X - $100X

$12,500= $1700X

X = approximately 8 clients

The result is that with a higher price, the consultant can reach her profit goal and cover her costs with a feasible number of clients per month. Whether or not such a price will take her out of the market is another question that should be addressed. Whether the consultant will actually be able to find 8 clients per month is also an issue. The point here, though, is that once again break-even analysis can help set prices.

It should be clear that service businesses could benefit from break-even analysis in every way that retail and manufacturing firms do. It simply requires a little deeper thinking about what it is that a service firm sells.

AN OPTIONAL METHOD OF ANALYSIS: USE OF CONTRIBUTION MARGIN

In these examples, we see that in solving the equations, the variable cost per unit has been subtracted from the sales price per unit. The difference between sales price per unit and variable cost per unit is called the *Contribution Margin*. In mathematical terms it is defined like this:

Contribution margin = Unit sales price - Variable cost per unit

So an alternative method for finding break-even values (and much more), called the *unit contribution method*, is actually a refinement of the profit break-even formula. You can think of contribution margin as the amount of money, per unit sold that is left to contribute towards paying fixed costs after all variable costs are covered.

Let's look at how you can make use of the unit contribution method. First, we will develop a formula to use and then explore some applications of the technique.

Recall the profit break-even formula:

Profit + Fixed costs + Variable costs = Net sales revenue

After subtracting variable costs from both sides, the formula becomes:

Profit + Fixed costs = Net sales revenue - Variable costs

In the examples from previous sections, unit sales price and variable cost per unit were always multiplied by "X", which represented the break-even number of chairs. Of course, unit sales price times X is net sales revenue and variable cost per unit times X is variable costs. So, the formula above is equivalent to:

Profit + Fixed costs = [Unit sales price - Variable cost per unit] X

The right hand side of the equation above in brackets is defined as contribution margin. The formula becomes:

Profit + Fixed costs = (Contribution margin) X

and by solving for "X" we find the contribution margin formula for break-even, which is given by:

Profit + Fixed costs/Contribution margins = X = the break-even level in units

Notice that the unit contribution form of break-even analysis will give the same results as the profit breakeven formula. Plugging in the appropriate values from the previous Reliable Chair example can show this.

$50,000 + $34,950/$250 - $100 = $84,950/$150 = 567 chairs (rounded)

Once again this formula shows Reliable must produce 567 chairs to meet its profit goal of $50,000 for the month.

You may wonder why the unit contribution method is needed at all because it gives the same results as the profit break-even formula. One reason to prefer this method is because a contribution margin is often known for a particular product. Therefore, it offers a chance to compare profitability between different product lines. Such comparisons are usually done using a contribution margin ratio.

Remember: Contribution Margin = Unit Sales Price - Variable Cost Per Unit
Contribution margin ratio (C/M ratio) is defined as:

Contribution margin/Unit sales price

For example, the C/M ratio of Reliable Chair's solid wood chair line is:

C/M ratio = $250-$100/$250
$150/$250 = .60 or 60%

One way to think about this 60% is that for each dollar in sales revenue, $0.60 is available to contribute to covering fixed costs. Naturally, the higher the C/M ratio, the higher the profitability of that line. This is because, as the C/M ratio increases (assuming fixed costs remain constant), you will cover the same amount of fixed costs, but more of your sales dollar will go directly to profit. The C/M ratio is often used directly as a relative measure of profitability.

You may see the C/M ratio listed in other sources as: C/M ratio = (1.0 - Variable expense ratio). The variable expense ratio is the ratio of variable cost per unit to the unit sales price:

Variable cost per unit/Unit sales price

In our example:

Variable expense ratio = $100/$250 = .40 or 40%
C/M ratio = (1.0 - .40) = .60 or 60%

Often, on income statements, the contribution margin is listed as "gross profit on sales." Do not be confused. "Gross profit" and "gross margin" are the same, and are often incorrectly used as labels for profitability ratios. The C/M or profit margin ratio is simply an expression of gross profit as a percentage of sales.

Another reason to prefer using the contribution margin method to the profit break-even formula is that the C/M ratio can be used to predict the impact on net income for any given dollar change in total sales. For example, a C/M ratio of 60% also means that for every one-dollar increase in sales for that product, the amount available to cover expenses (the contribution margin) will increase by 60 cents. Net income from that product line will also increase by 60 cents, assuming there are no changes in fixed expenses or in the price.

The contribution margin and C/M ratio can also be used in matters regarding the sales mix, degree of operating leverage, margin of safety, and a host of other important topics. These issues are beyond the scope of this guide. The interested reader is directed to check the library or the subject guide to Books In Print at any good bookstore for further investigation of those topics.

THE LAST WORD: LIMITATIONS OF BREAK-EVEN ANALYSIS

There are some limitations to the use of break-even analysis that should be understood. First, it must be remembered that such an analysis involves estimated projections of expected sales, fixed costs, variable costs, and the costs that have both fixed and variable characteristics. Avoid a false sense of security regarding your mathematically sound results. They are, after all, based on projections.

Second, break-even analysis is useful only over a limited range of sales volume extending not too far from the expected level of sales. Moving much beyond that range will require additional capital expenditures for more floor space, or machinery, or more sales people, which will distort the estimates of fixed and variable costs.

Third, it is generally accepted in basic financial theory that the appropriate way to make investment or capital decisions is to consider the "discounted value of the cash flows" of a proposed project. Such an analysis focuses on the time value of money to better describe the "true" value of an investment. Break-even analysis does not focus on the time value of money. Nor does it focus on opportunity costs. Opportunity costs relate to the best alternative use of your money. There are always alternative uses for funds that may be more profitable than the project or expansion under consideration. Break-even analysis views every project in isolation.

Finally, there is an assumption made in doing break-even analysis that the cost-revenue relationship is linear. This may or may not be the case for any particular business. For example, many businesses experience a reduction in fixed and variable costs per unit as the overall scale of the business increases. This is referred to as "economies of scale." Most very small businesses do not experience significant economies of scale.

Despite its limitations, break-even analysis is a very useful tool with which to approach a variety of decision problems. Such questions as the costs of expansion, evaluation of sales or profit performance, estimation of the impact of various expenses on profit, setting prices, and financial analysis in general are appropriately addressed using break-even analysis. It is not a panacea. It is only one of the many tools available to the decision maker. It is best used in conjunction with other financial analysis techniques or as a screening device to determine whether more study is needed. In any case, familiarity with break-even analysis is a must for any businessperson.

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